

Challenges and Factors Associated With Adherence to Non-Pharmaceutical Interventions to Prevent the Spread of COVID-19 in a Slum Setting

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Abstract

Objectives

This study aims to evaluate the challenges of implementing non-pharmaceutical interventions, assess adherence, accessibility to prevention materials and identify requirements for the control of the spread of COVID-19 among individuals living in a slum-setting in Lagos, Nigeria.

Methods

This is a five-month cross-sectional study conducted in Makoko, Lagos an urban-slum community. Data on sociodemographic characteristics, living conditions and adherence to COVID-19 prevention strategies were obtained with a semi-structured questionnaire. Logistics-regression model was used to determine factors associated with adherence to COVID-19 preventive measures.

Results

There was a total of 357 participants who had a mean age of 45.8 ± 12.9 years. Majority were males (62.2%), married (83.8%), self-employed (66.4%), and had secondary education (31.4%). Most participants (93.8%) had no space for self-isolation as majority lived in a one-room apartment (72.8%), shared toilets/kitchen space (64.4 %), had no constant source of water supply (61.9%) and buy water (62.5%). About 98.8% are aware of the COVID-19 pandemic but only 33.9% adhered. Most of the participants disclosed inability to purchase face masks/ hand sanitizers (68.9%).

After adjusting for covariates, the ability to afford facemasks/hand sanitizers ($P < 0.0001$, [aOR]

6.646; 95% CI: 3.805-11.609), living alone ($P < 0.0001$, [aOR] 3.658; 95% CI: 1.267-10.558), and ability to buy water (aOR: 0.27; 95% CI: 0.14-0.50), had greater odds of association with adherence to the non-pharmaceutical COVID-19 preventive measures.

Conclusion

The lack of isolation space among majority of the respondents calls for concern. Inability to purchase prevention materials is a major factor influencing poor compliance to COVID-19 prevention strategies.

Introduction

The World Health Organization (WHO) advocated non-pharmaceutical Interventions (NPIs) to curtail the spread of COVID-19 globally while research efforts concentrated on other pharmaceutical interventions were ongoing. The rapidity with which the disease has been transmitted led to the development of several guidelines for infection control and preventive measures. These measures were adopted instantly and integrated into containment strategies to interrupt viral transmission by different governments [1, 2].

The novel disease had no known curative therapy or vaccine at the inception of the pandemic therefore efforts were targeted towards clinical trials, non-pharmaceutical interventions, and vaccine development [3].

Non-pharmaceutical interventions are public health measures targeted at behavioral changes in a bid to interrupt the infection chain and transmission of the severe acute respiratory syndrome coronavirus (SARS-COV-2) in humans [4].

These non-pharmaceutical interventions include facial masking, lockdown measures, social distancing, hand hygiene, cough etiquettes, isolation, and quarantine measures among others [5]. These interventions have proven to be effective in reducing the spread of COVID-19 disease among humans [6].

Although, most of these measures had a negative impact on societal functioning, human relations and the economy, their implementation was sacrosanct to curb the

spread and flattening the curve of rising COVID-19 cases in various countries. [7, 8].

Households have been identified as potential and probable settings for the transmission of COVID-19 diseases because several factors such as ventilation, shared spaces, and proximity might be challenging to control especially in clustered settings [9].

The slum settings used in this study refers to highly populated residential areas where housing is not in compliance with the original planning and building regulations [10].

The standard of living and hygiene situations in slums are usually not satisfactory and residents do not have access to most government amenities such as water supply. Factors which are important determinants of person-to-person transmission such as proximity, ventilation, social distancing are challenging to control in these settings [11].

In instituting a national lock down and restriction of movement, individuals in these settings are forced to stay at home together in this environment where living space constrain most facilities which are meant to be shared, and water supply is grossly inadequate.

This study aims to evaluate the challenges of implementing non-pharmaceutical interventions, assess adherence and associated factors, accessibility to prevention materials and identify requirements to the successful control of the spread of COVID-19 among individuals living in slums and crowded areas in Lagos state, Nigeria.

Methodology

Study Design

This study was a cross sectional study using a semi-structured questionnaire to obtain data from the respondents over a period of five months from May to September 2020. Adherence to non-pharmaceutical intervention was determined by calculating an adherence index from 10 evidence based protective behaviors and a self-report of adhering to all the measures was termed total adherence in contrast a non-adherence to one or

more of the measures was termed partial adherence.

Total adherence to the stated COVID-19 non-pharmaceutical prevention measures was considered the required adherence. It was assumed that defaulting in any of the measures could predispose to contacting the virus therefore it was an 'all or none' criteria.

Study Setting

This study was conducted among individuals who reside in an urban slum setting in Lagos state. Makoko is an informal setting in the Lagos central senatorial district located across the coast of the Atlantic Ocean along the third mainland bridge in Lagos, where majority of the structures are built on stilts and other buildings are constructed on the land.

Study Population

The study population were adults aged 18 years and above who resided in the selected slum community and consented to participate in the study.

Ethics and Informed Consent

Ethical approval for the study was obtained from the Institutional Review Board of the Nigerian Institute of Medical Research and respondents gave informed consent. Individuals who declined to participate were excluded from the study.

Recruitment Procedure

A semi-structured questionnaire was administered to an adult member of the selected households via a convenient sampling procedure. Individuals who gave consent to participate were recruited from 365 households and those who declined to participate and were excluded from the study.

Results

Of the 365 participants, 357 completed the questionnaires and this was used for the analysis. Most of the respondents were aged 41-50 years (35%), males (62.2%), married (83.8%), self-employed (66.4%) and had secondary level (31.4%) of education (Table 1).

Almost all the respondents were aware of the COVID-19 pandemic and its recommended non

pharmaceutical preventive measures (98.9%) however only 33.9% reported total adherence to the measures.

A good number of the respondents used facial mask coverings (77.3%) while approximately a quarter of the respondents used hand sanitizers (25.2%), practiced social distancing (22.1%), engaged in frequent washing of hands (28.3%) and avoided handshakes (23.2%).

Majority reported not adhering to recommended cough etiquette (82.6%), avoiding handshakes (77.6%), crowded places (86%), or touching of the face (85.2%), nose or mouth (Table 2).

An assessment of the living conditions of the respondents showed that majority shared kitchen (63.6%) and toilet facilities (64.4%) while a very high percentage do not have a space for isolation (93.9%) in the event of exposure to an infected person.

A total of 260 (72.8%) residents lived in a one room space and 66.7 % of the houses had only one window, with 31.9% sharing one room with four or more persons.

Over half of the respondents buy water (62.5%) or do not have constant supply of water (61.9%). Furthermore, 68.9% and 70.3% cannot afford to buy facemasks or hand sanitizers respectively (Table 3).

Major challenges identified as reasons for not adhering to non-pharmaceutical preventive measures were lack of water, lack of space or extra room for isolation, crowded living conditions, lack of funds, lack of prevention materials, poverty, forgetfulness, misconception about the pandemic and lack of palliatives among other reasons (Table 4).

Strategies such as the provision of free supply of prevention materials, institution of standard housing scheme, continuous sensitization, government supply of constant water to all homes, provisions of funds, provision of palliatives, engage monitoring team to enforce adherence were some of the suggested strategies to enhance total adherence among residents (Table 4).

Table 5 shows the results of factors associated with adherence to non-pharmaceutical COVID-19

Table 1. Socio-Demographic Characteristics of Respondents

| Characteristics | Total no of respondents (%) |
|---------------------------------------|-----------------------------|
| Respondents' characteristics, n = 357 | |
| Mean age | 45.8 ± 12.9 years |
| Age group | |
| 20-30 | 33(9.2) |
| 31-40 | 104(29.1) |
| 41-50 | 125(35.0) |
| 51-60 | 47(13.2) |
| >60 | 48(13.5) |
| Sex | |
| Male | 222(62.2) |
| Female | 135(37.8) |
| Marital Status | |
| Single | 16 (4.5) |
| Married | 299(83.8) |
| Divorced/separated | 18(5.0) |
| Widowed | 24(6.7) |
| Employment Status | |
| Employed | 60(16.8) |
| Self employed | 237(66.4) |
| Unemployed | 60(16.8) |
| Religion | |
| Islam | 181(48.3) |
| Christianity | 134(35.7) |
| Others | 42(11.8) |
| Ethnic group | |
| Yoruba | 156(43.7) |
| Hausa | 95(26.6) |
| Igbo | 60(16.8) |
| Other tribes | 46(12.9) |
| Educational status | |
| Non formal | 98(27.5) |
| Primary | 66 (18.5) |
| Secondary | 112(31.4) |
| Tertiary | 81(22.6) |

Table 2. Assessment of awareness, facilities, and adherence to non-pharmaceutical COVID-19 preventive measures among the respondents

| Awareness | Yes | No |
|--|------------|------------|
| Awareness of the COVID-19 pandemic | 353(98.9) | 4(1.1) |
| Awareness of prevention measures | 353(98.9) | 4(1.1) |
| Adherence and use of preventive measures | | |
| Total Adherence to preventive measures | 121(33.9) | 236 (66.1) |
| Use of face masks | 276(77.3) | 81(22.7) |
| Use of hand sanitizers | 90(25.2) | 267(74.8) |
| Social distancing | 79(22.1) | 278(77.9) |
| Observe cough etiquette | 62(17.4) | 295(82.6) |
| Wash hands frequently with soap | 101(28.3) | 256(71.7) |
| Avoid handshakes | 83(23.2) | 277(77.6) |
| Avoid crowded places | 50(14) | 307(86) |
| Avoid touching face, nose and mouth | 53(14.8) | 304(85.2) |
| Avoid sharing utensils and personal items in the home | 20(5.6) | 337(94.4) |
| Visiting a friend /family/neighbour during the lock down | 308(86.3) | 49 (13.7) |
| Availability of facilities and amenities | | |
| Shared toilet /kitchen facilities with other families | 230(64.4) | 127(35.6) |
| Availability of Isolation space or spare room | 335(93.9) | 22(6.2) |
| Living alone | 22(6.2) | 335(93.9) |
| Constant supply of water | 136(38.1) | 221(61.9) |
| Afford face masks / hand sanitizers | 111(31.1) | 246(68.9) |
| Buying water | 223(62.5) | 134(37.5) |

Table 3. Living conditions of respondents

| Living conditions | Frequency |
|--|------------------|
| Source of water | |
| Water vendor | 225(63) |
| Pipe borne water | 60(16.8) |
| Well | 72(20.2) |
| Number of rooms | |
| 1 | 260(72.8) |
| 2 | 97(27.2) |
| Number of windows | |
| 0 | 8(2.2) |
| 1 | 238(66.7) |
| 2 | 111(31.1) |
| Number of individuals sleeping in a room | |
| 1 | 31(8.7) |
| 2 | 111(31.1) |
| 3 | 101(28.3) |
| ≥4 | 114(31.9) |

Table 4. Challenges responsible for non-adherence to COVID-19 preventive measures and strategies to improve adherence

| Challenges and reasons | Frequency (%) |
|--|----------------------|
| Difficulty breathing through the mask | 4 (1.1) |
| Lack of water | 243 (68.1) |
| Lack of funds | 109 (30.5) |
| Lack of prevention materials | 150 (42) |
| Unbelief | 9 (2.5) |
| Lack of extra room | 260 (72.8) |
| Boredom and the desire to go out | 11(3.1) |
| Lack of electricity during lockdown | 250 (70) |
| Lack of proper information | 25(7) |
| Poor sensitization | 32 (8.9) |
| Lack of space for social distancing or isolation | 335(93.8) |
| Crowded living conditions | 52 (14.6) |
| Illiteracy | 5(1.4) |
| Misconception that the pandemic is meant for the rich | 34 (9.5) |
| Hunger and the need to source for a means of livelihood | 9 (2.5) |
| Forgetfulness | 22 (6.2) |
| Impression the government is lying about the pandemic | 25 (7) |
| Lack of palliatives from the government | 50 (14) |
| Infected persons were not shown to us to make us believe | 10 (2.8) |
| Indiscipline and nonchalant attitude | 14 (3.9) |
| Poverty | 89 (24.9) |
| Long duration of lock down | 5(1.4) |
| Strategies | |
| Provision of free supply of prevention materials | 55 (15.4) |
| Institution of standard housing scheme | 60 (16.8) |
| Continuous sensitization | 70 (19.6) |
| Government supply of constant water to homes | 72 (20.1) |
| Provision of sufficient palliatives directly to individuals | 75 (21.0) |
| Establishment of strict lock down measures | 32 (8.9) |
| Show infected individuals | 4(1.1) |
| Education of the public | 18 (5.0) |
| Provision of running water and soap on streets and public places | 13(3.6) |
| Provision of funds during the lockdown | 5 (1.4) |
| Engage monitoring team to enforce adherence | 24(6.7) |
| Government transparency | 12(3.4) |
| Maintaining personal hygiene | 4(1.1) |
| Improved living conditions | 28(7.8) |

Note that there are multiple responses from respondents and frequency will not add up to 100%

Table 5. The result of logistic regression analysis of variables associated with adherence to non-pharmaceutical preventive measures

| Factors | cOR (95% CI) | aOR (95% CI) |
|-------------------------------|---------------------|-----------------------|
| Sex | 1.098 (0.698-1.729) | 0.572 (0.319 - 1.026) |
| Buying water | 0.152(0.094-0.247) | 0.266 (0.142 - 0.498) |
| Share toilet/ kitchen | 0.195 (0.121-0.313) | 0.556 (0.298-1.036) |
| Afford face masks/ sanitizers | 8.468(5.102-14.056) | 6.646 (3.805-11.609) |
| Living alone | 3.036(1.259-7.329) | 3.658 (1.267-10.558) |
| Number of rooms | 1.127(0.685-1.853) | 1.073 (0.548 - 2.100) |

preventive measures from a logistics regression analysis. After adjusting for all covariates, the ability to afford facemasks/hand sanitizers (aOR: 6.65; 95% CI: 3.81-11.61), living alone (aOR: 3.66; 95% CI: 1.27-10.56), and ability to buy water (aOR: 0.27; 95% CI: 0.14-0.50), were found to have an independent association with adherence to non-pharmaceutical intervention measures against COVID-19 and had greater odds of being associated with total adherence to the non-pharmaceutical COVID-19 preventive measures.

Factors such as sex (aOR:0.57; 95% CI:0.32-1.03), sharing of toilet facilities / kitchen space (aOR: 0.27; 95% CI:0.20-1.76), and the number of rooms in a house (aOR:1.07;95%CI:0.55-2.10) were found not to be associated with total or partial adherence to non-pharmaceutical intervention measures against COVID-19.

Discussion

The government of various countries instituted non-pharmaceutical interventions at varying degrees to curb the spread and flatten the curve of rising infection rates while efforts at developing vaccines and effective drug therapy were ongoing [12, 13].

Spinelli and colleagues [14] have emphasized the need for continued implementation of non-pharmaceutical interventions even as vaccines are rolled out because these interventions will continue to play a critical role in suppressing SARS-CoV-2 virus transmission.

Al-Waiydy and Mohammed [15] reported the profound impact of the early implementation of these measures in curbing the spread of the virus. The prolonged implementation of the COVID-19 preventive measures impacts family, community, national, and global economic activities. The unprecedented nature of some restrictions and measures made adherence to these interventions quite challenging despite its potential benefits and has resulted in pandemic fatigue [16].

Human interaction is a major engine of transmission of the SARS-CoV-2 virus; the effectiveness and impact of these measures are dependent on societal cooperation and adherence [17]. In this study societal cooperation and adherence was seen in less than half of the study population.

The use of face masks forms a barrier that prevents viral material between an individual who sneezes or coughs out droplets of contagious materials and the individual who inhales if both parties wear a face mask.

While social distancing measures are necessary to fill the gap between individuals because the SARS-CoV-2 virus is known to have a higher viral inoculum at closer distances to the infected persons. Adequate spacing between individuals also prevents expelled viral particles from having ample time to stay airborne and be inhaled before it settles on the ground and die off [1].

Various studies have investigated the effect of the

individual non-pharmaceutical interventions, group of multiple interventions and the degree of adherence to these measures [18]. Adhering to all the non-pharmaceutical measures is sacrosanct to minimize the chances of viral transmission.

Eikenberry *et al.*, 2020 [19] reported that wearing a face mask reduced daily deaths by 17% - 45% over a two-month period while Zhang *et al.*, 2020 [20] in China observed a 98.9% reduction in new infection cases because of the implementation of social distancing and epicenter lockdown.

Reports from developed countries shows varying degrees of adherence ranging from 49% in USA to 95% in Hong Kong and 100% in Vietnam to the use of face masks. In this study, we found a relatively high adherence (77%) to the use of face mask, but a low adherence to the use of hand sanitizers (25.2%), social distancing (22.1%), washing of hands (28.3%) and observation of cough etiquettes (17.4%). Compared to reports from other countries it can be deduced that adherence pattern varies among regions and continents. Crane *et al.* [16] reported pandemic fatigue to other measures and a decrease in adherence except for face masks which improved to 88.6%. The finding may be similar to our findings which reported high adherence to face masks but very low adherence to other measures. However, we were unable to observe the change in adherence pattern over time because of the cross-sectional nature of our study.

The slum settings are known to be congested, crowded, and a deviation from the legal and organized plan. Transmission within the households contributed to the COVID-19 cases during the lockdown measures in the early period of the pandemic [21].

The crowded and close-knit nature of slum settings calls for attention regarding the implementation and adherence to these interventions. Cerami *et al.*, 2021 [22] have emphasized the role of households in viral transmission due to shared living space. This study has observed a wide range of challenges to adhere to these measures; however, the majority of the respondents identified lack of space, prevention materials, water, and

funds among other reasons. The ability to afford facemasks/sanitizers and living alone have been observed to have a strong association with total adherence to the non-pharmaceutical interventions in this study.

A self-report determined total adherence in this study from the respondents, which might overestimate or underestimate the true picture hence an observed limitation of the study. Also, as explained in this study, total adherence is not a validated measure, but the idea was adopted from Crane *et al.* [16] It has given an insight into factors associated with total adherence. Most of the individuals in these settings buy water (62.5%) for daily use and frequent hand washing is a challenge. Furthermore, space for social distancing critical to curtailing the spread is in short supply in the slum setting studied. The respondents suggested that continuous sanitization, a standard housing scheme, constant water supply to homes and provision of palliatives will enhance adherence to the non-pharmaceutical interventions.

Iftimie *et al.*, 2021 [23] suggested that emergence of new variants and poor adherence to social distancing have contributed to the recurrent wave experienced in many countries. In addition, relaxation of restrictions and containment measure have also contributed to the pandemic waves [24]. All these has re-emphasized the importance of the non-pharmaceutical interventions.

Lifestyle in the slums entails close human interactions due to the living conditions; therefore, environments with these characteristics should be given closer attention in monitoring / enforcing the practice of containment measures. Such communities should prioritize vaccination to prevent them from being a hub for circulation and recirculation of the virus.

Conclusion

Implementing non-pharmaceutical interventions in slum household settings can be challenging because of the living conditions. The lack of isolation space among almost all the respondents calls for concern. Inability to purchase prevention materials and sharing living space are significant factors influencing poor adherence to COVID-19 prevention strategies. There is a need to review

the living conditions in the slums, institute some basic amenities, and prioritize vaccinating this cohort of individuals to avert the spread of infectious diseases like COVID-19.

Ethical Approval

Ethical approval was obtained from the Institutional Review Board of the Nigerian Institute of Medical Research (IRB Approval Number 20-030).

Competing Interest

All authors declare no competing interest

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Authors Contribution

Conceptualization: ESO. Data curation: ESO, SAO, OOO. Formal analysis: ESO, DAN. Funding acquisition: SBL, GTA. Methodology: ESO, GTA, SAO, OOO. Project administration: ESO, GTA, SAO. Visualization: ESO, EOC. Writing - original draft: ESO, EOC. Writing - review & editing: DAN, EOC, SBL. All authors have read and approved of the final manuscript.

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